**You might recognise this thing. It’s called Maslow’s Hierarchy of needs and it was created in 1943 by a psychologist called Abraham Maslow to help achieve a better understanding of human behavioural motivation.**

**What’s that got to do with climate change? I hear you ask. Fair question. Well, Maslow’s point was that we humans can’t get to any of these higher levels of enlightenment until we’ve satisfied these basic fundamental human requirements. So, unless we’ve got clean air to breathe, water to drink, food to eat and shelter for warmth, we’re unlikely to have much spare time to consider the more esoteric things in life up here in the Self Actualisation section – things like morality and acceptance of facts.**

**I mention it not because this video is going to be a deep dive into human psychology, but simply because it’s a useful reminder of just how essential these basics are to human existence. I talk a lot on this channel about technological breakthroughs that might help accelerate our transition towards a more sustainable future, but this simple pyramid shows us that unless we maintain clean air, and manage our land so that there’s enough drinkable water and edible food for everyone in our rapidly expanding global population, those exciting shiny new technologies will be completely pointless.**

**Our global land and food systems are under immense pressure, not only from climate change but also from our own modern industrial scale agricultural practices, which are stripping the earth of essential nutrients and killing all the creepy crawlies that make up the ecosystems that keep healthy soils alive. And those practices are also pulling great dollops of carbon out of the ground and releasing it up into the atmosphere as carbon dioxide, which we could well do without, as I’m sure you know.**

**So, in recent years a small but now rapidly growing movement has been building in many countries around the world. It represents a radical, and arguably revolutionary way to manage the land, prioritising the health of the soil rather than short term crop yield and profit. It’s called Regenerative Agriculture and it’s caused of great deal of controversy and debate, especially in the farming community, with some folks remaining extremely sceptical of its claims while others enthusiastically embrace the new techniques, presenting them as the future of land management, and the fastest way to solve climate change.**

**So, are these new pioneers really on the right track?**

**Hello and welcome to Just Have a Think,**

**It’s hard to overstate the fundamental importance of healthy soil to all land-based life on earth. Hundreds of millions of years ago there was no soil at all though, and of course there was no land-based life either. Back then our planet’s surface was made up almost entirely of rock, much of which contained minerals and nutrients like phospherous, calcium and zinc that would get leeched out by heavy rain and run off into the sea. As life got going in the oceans it used these nutrients to develop. Eventually fungi and algae got swept up onto the land and combined to make lichens, which had not only evolved the quite miraculous ability to harness the energy of the sun for photosynthesis but could also solubilise the essential nutrients out of the rocks without having to wait for the rain to do it for them. That solubilisation left little air gaps between rock particles and as the lichens moved on, they left bits of spongy organic detritus that filled up those gaps. And water could now get into the crevices too. So, over millions of years, through a process called pedogenesis, much of that early rock got transformed into the soil we know today.**

**About a hundred million years or so after lichens appeared, the planet was in a period known as the Carboniferous Permian with lush forests and deep organic soils teeming with life. Carbon Dioxide was being drawn out of the atmosphere by plants and the carbon was being fixed into the soil by fungi, which got their energy from the sugars that the plants released. The grasslands that had evolved by about fifty million years ago, existed and flourished as a result of a symbiotic relationship with the herbivores that evolved alongside them. The herbivores got to eat the grass and in doing so they broke up the surface soil, spread seeds around and distributed their own brand of natural organic fertilizer on the land. Then they moved on and did the same thing somewhere else, allowing the grassland they left behind to benefit fully from their activity. That interaction kept the soil healthy, retained its carbon and moisture content and prevented the grasslands turning to desert.**

**So much CO2 was drawn down into the soil during that geological period that atmospheric concentrations went from a starting point of about eight thousand parts per million to only about a hundred. In fact, our soils are now the second largest carbon sink we have on the planet, surpassed only by our vast deep oceans.**

**Nowadays we humans dominate the land through our agricultural and forestry practices. In farming, the focus has always been on maximizing the size and weight of the parts of plants that we can eat. But that only accounts for about thirty percent of the overall biomass of the crop. There’s another thirty percent in the root systems, and the final thirty to forty percent gets released into the soil as sugars and amino acids. And it’s these sugars and amino acids that drive the microbes that make the springy detritus between the soil particles and keep the whole system spongy and absorbent.**

**A good healthy soil can have as much as twenty five thousand kilometres of fungal filaments, or hyphae, in a single cubic metre, as well as a hugely diverse ecosystem of bacteria, protozoa's, earth worms and all sorts of other creepy crawlies all contributing to the constant cycling of nutrients. Recent studies show that one tablespoon of healthy topsoil can contain about a billion microorganisms But, we humans are doing some serious damage to the balance that nature painstakingly evolved in our soils over hundreds of millions of years. Of the eight billion hectares of forestry land that existed at the end of the last ice age, we’ve managed to clear about fifty percent, so we’re down to about four billion hectares today, and every year we cut down or burn about three hundred and fifty million hectares of what’s left plus about two billion hectares of grassland, crop stubble and rangelands. Once we’ve burnt the stubble and residue, we plough and till the soil to prepare for new crops to be planted. That cultivation of the topsoil releases more carbon dioxide and exposes the microorganisms to harmful UV sunlight which kills them. Without those microorganisms the crops can’t get the nutrients they need, so to compensate for that we over-fertilize the land with things like nitrates. And every gram of excess nitrate oxidises thirty grams of carbon into carbon dioxide. And then we tend to overwater the crops which actually restricts fungal growth and slows down productivity. And finally, just to be on the safe side, we apply biocides to the crops to kill any unwanted critters from eating our produce. The biocides do that very effectively. They also kill all the other organic life in the soil as well.**

**And as the carbon leaves the soil, any surviving fungi have less and less of it to trade with the plants for the sugars they need. That means no more springy detritus between the soil particles and no more air gaps for root systems to travel easily through, so the soil collapses back to a compacted impervious material and we humans are left with dust bowls and deserts.**

**One of the pioneers of a more holistic approach to land management is Zimbabwean ecologist and livestock farmer Allan Savory. He’s been applying a regenerative systems approach to soil health since the middle of the last century. He and other advocates claim their land management techniques can avoid degradation of existing farmland AND breathe life back into vast areas of the world afflicted by human induced desertification. The theory has been somewhat controversial though. Savory has won much praise and several awards for his ground-breaking work over the years, but he’s also attracted his share of critics who claim his ideas are not based on sound science and could do more harm than good. So, what are the principles of regenerative agriculture?**

**Well firstly, there’s minimal soil disturbance either from tillage or from adding chemicals. That keeps carbon in the ground and allows the essential microorganisms to flourish.**

**Secondly, the soil is kept covered when a cash crop is not being grown. The old technique of keeping land fallow is actually just a starvation diet for the soil and the creepy crawlies, putting that land into a sort coma like state of suspension with no beneficial activity taking place. Regenerative land managers put a cover crop in during fallow periods to maintain a healthy root system all year round and keep the soil active and healthy.**

**Thirdly, by maximizing crop diversity, farmers can naturally reduce the incidence of pests and disease and improve nutrient cycling, which supports greater biodiversity and improves the overall health of the soil without pesticides.**

**And last but not least, copying natures symbiotic relationship between herbivores and grasslands by actively moving herds of livestock animals from one area of land to another on the farm. That allows them to graze the grass, trample the ground, break up the surface and distribute their waste products before being moved on to the next zone. This can be done several times a day – it’s labour intensive, but the land managers can see the benefits that the system brings.**

**Over in Australia there are more than a thousand farmers currently participating in the Healthy Soils Australia program. According to this 2018 Harvard lecture by advocate Walter Jehne, those farmers are managing to retain a one hundred percent crop yield with three times the quality and nutritional integrity of the food grains. And they’re doing that with less than twenty percent of the inputs, less than ten percent of the risk to land loss, three times the reliability, and five times the natural land capital and soil regeneration value.**

**Similar successes are being enjoyed by visionary farmers here in the UK too. This October 2020 article picks out just one example at the fourteen hundred hectare, Ken Hill Farm and Estate in Norfolk, run by Estate Manager Nick Padwick.**

**Padwick identified about two hundred hectares of lowest performing arable land which he turned into wood pasture alongside another two hundred hectares of existing woodland. He plans to keep livestock on that pasture including cattle, pigs and Exmoor ponies. Of the remaining six hundred and twenty-five hectares of arable land, a further one hundred and seventy-six have been removed from crop production to create a corridor of environmental habitat and biodiversity stretching right across the estate from south-west to north east. And Padwick has split the productive arable land up into rectangles with tightly controlled farming traffic which abandons the old system of plough, press, cultivate and drill in favour of the more regenerative techniques of minimum tillage and direct drilling. Government incentives for this type of regeneration mean that the land will yield a greater profit than it was achieving with the old arable crop set up. Within a year of taking over, Padwicks transformation had saved forty thousand pounds on diesel and reduced fixed costs from five hundred and sixty two pounds per hectare to three hundred and thirty pounds – a saving of more than forty percent.**

**Over in the States, the Soil Health Institute is working hard to meet the triple challenge of climate change, water quality, and food security by implementing a strategic approach for tackling the financial, technical, and educational barriers to adopting soil health systems. A growing number of US farmers and ranchers are adopting these new practices and transforming their land. The overall aim is to achieve net zero carbon emissions from agricultural land in the United States by 2040. The Soil Health Institute say that’s the equivalent of taking nearly one and a half billion cars off the road.**

**Their 2018 Living Soil film showcases real-world examples of where this is already being achieved. I’ll leave a link to the full film in the description box below- it’s well worth a watch.**

**And it’s not just farmland that can benefit. Across the planet there’s about nine billion acres of degraded land that has the potential to be brought back to life through regenerative agricultural practices.**

**This guy is called John D Liu. For more than fifteen years now, his work in China and other parts of the world has breathed life back into millions of hectares of degraded land that had previously been written off as completely dead and infertile. By careful stewardship, water management and a deep respect for natural processes he’s achieved some quite spectacular transformations.**

**Another practitioner called Neal Spackman spent a decade leading a team of local Bedouin workers in a remote region of the Saudi Desert called Al Baydha to restore that area to the healthy and sustainable habitat that it HAD been before humans came along and chopped down all the trees there.**

**Spackman is now working with an organisation called the Regenerative Resources Company, who focus on bringing back much of the world’s coastal wetlands through regenerative seawater agriculture and aqua culture. Mangroves sequester carbon fifty times more efficiently than tropical forests and provide habitat for hundreds of species of fish, migratory birds, amphibians and other wildlife. The monetary value these mangroves provide in ecological services is estimated at about a hundred thousand dollars and acre. And these are just a few of the many examples of land restoration taking place in many parts of the world.**

**Our climate scientists tell us that we’ve now sailed past the point where just reducing our carbon emissions can keep global temperatures below two degrees above pre-industrial levels. We now need to draw existing carbon dioxide back out of our atmosphere. Technology might help us a little bit, with things like direct air carbon capture and sequestration, but the cost of those initiatives will be mind boggling and their impact is yet to be proven. We could instead just learn from nature and restore our natural ecosystems through relatively cheap and simple techniques like regenerative agriculture, rewilding and reforestation.**

**I know this is yet another contentious issue so if you have strong views or direct experience that you can share, then jump down to the comments section below and leave your thoughts there.**

**That’s it for this week though.**

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**As always, thanks very much for watching, have a great week, and remember to Just Have a Think.
See you next week**